Forma Scientific, Inc.

Millcreek Road, P.O. Box 649
Marietta, Ohio 45750
U.S.A.

Telephone: (740) 373-4763
Telefax: (740) 373-4189

Models:
707, 771, 733 and 754

Non-CFC, Ultra-Low Temperature
Chest Freezers

3.0 and 6.7 cu. ft. capacity

Manual No. 7000707 **Rev. 3**

Read this Instruction Manual

Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel and poor equipment performance.

CAUTION: All internal adjustments and maintenance must be performed by qualified service personnel.

Refer to the serial tag on the back cover of this manual

*Refer to listing of all model numbers on page ii.

*700 Series Freezers		
707	6.7 cu ft	120V
771	6.7 cu ft	230V
733	3.0 cu ft	120V
754	3.0 cu ft	230V

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MANUAL NO. 7000707

REV	ECR/ECN	DATE	DESCRIPTION	By
3	19279/FR-1402	6/21/00	Revised electrical schematics	aks
2	FR-1357	12/1/99	Updated per A. Thomas for IEC 1010 (CE listing)	ccs
--	18249/SI-7545	7/7/99	Added P/N 195518 & 195519 air filter kits to parts list	ccp
1	18286/FR-1296	5/11/99	Updated schematics for 771/5477	ccp
--	--	11/17/98	Added battery change note to Section 3.6	deg
---	FR-1223	6/8/98	Changed temp board	heg
--	FR-1203	5/26/98	Added metric units to ref. drawing for IEC-1010	
0		2/98	Original Manual	deg

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1-740-373-4189	FAX
http://www.forma.com	Internet Worldwide Web Home Page
forma.service@tmquest.com	Service E-Mail Address

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When more extensive service is necessary, we will assist you with direct factory trained technicians or a qualified service organization for on-the-spot repair. If your service need is covered by the warranty, we will arrange for the unit to be repaired at our expense and to your satisfaction.

Regardless of your needs, our professional telephone technicians are available to assist you Monday through Friday from 8:00 a.m. to 7:00 p.m. Eastern Time. Please contact us by telephone or fax. If you wish to write, our mailing address is:

ThermoQuest
Forma Scientific Division
Millcreek Road, PO Box 649
Marietta, OH 45750

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General Safety Notes used in this Manual

	Important operating and/or maintenance instructions. Read the accompanying text carefully. Ce symbole attire l'attention de l'utilisateur sur des instructions importantes de fonctionnement et/ou d'entretien. Il peut être utilisé seul ou avec d'autres symboles de sécurité. Lire attentivement le texte d'accompagnement. Wichtige Betriebs- und/oder Wartungshinweise. Lesen Sie den nachfolgenden Text sorgfältig. Importante instruccions de operacion y/o mantenimiento. Lea el texto acompanante cuidadosamente.

	Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol. Ce symbole attire l'attention de l'utilisateur sur des risques électriques potentiels. Seules des personnes qualifiées doivent appliquer les instructions et les procédures associées à ce symbole. Gefahr von Stromschlägen. Nur qualifizierte Personen sollten die Tätigkeiten ausführen, die mit diesem Symbol bezeichnet sind. Potencial de riesgos electricos. Solo personas das capacitadadas deben ejecutar los procedimientos asociadas con este simbulo.

	Equipment being maintained or serviced must be turned off and locked off to prevent possible injury. Risques potentiels liés à l'énergie. L'équipement en entretien ou en maintenance doit être éteint et mis sous clé pour éviter des blessures possibles. Geräte, an denen Wartungs- oder Servicearbeiten durchgeführt werden, müssen abgeschaltet und abgeschlossen werden, um Verletzungen zu vermeiden. El equipo recibiendo servicio o mantenimiento debe ser apagado y segurado para prevenir danos.

	Hot surface(s) present which may cause burns to unprotected skin or to materials which may be damaged by elevated temperatures Présence de surface(s) chaude(s) pouvant causer des brûlures sur la peau non protégée, ou sur des matières pouvant être endommagées par des températures élevées. Heiße Oberfläche(n) können ungeschützter Haut Verbrennungen zufügen oder Schäden an Materialien verursachen, die nicht hitzebeständig sind. Superficias calientes que pueden causar quemaduras a piel sin proteccion o a materiales que pueden estar danados por elevadas temperaturas.

- Always use the proper protective equipment (clothing, gloves, goggles etc.).
- Always dissipate extreme cold or heat and wear protective clothing.
- Always follow good hygiene practices.
- Each individual is responsible for his or her own safety.

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Section 1 - Installation and Start-Up

1.1 Unloading and Moving the Freezer

To remove the freezer from the pallet, use the 7/16” wrench to remove all the bolts securing the shipping bracket to the pallet. Remove the shipping bracket. Remove the ramp boards from the pallet and place the slotted end over the ramp brackets on the pallet. The support blocks on the ramps will be facing down. Before moving the freezer, make sure the casters are unlocked and moving freely. Align the caster with the ramp boards. Use adequate personnel to roll the freezer off the pallet.

If tipped more than 45°, allow the unit to set upright for 24 hours before start up.

The freezer can be easily pushed to the desired approved location that is described in Section 1.5. When the freezer is in position, set the front caster brakes.

The freezer must not be moved with the product load inside.

1.2 Getting to Know Your Freezer

A **LED display** - Shows actual chamber temperature and indicates the control temperature set point when the Press-To-Set button is pressed.

B **Condenser Hot indicator** - Lights when the thermostat on the condenser reaches 40°C, indicating typically a dirty air filter, a clogged condenser, a fan failure or high ambient temperature.

C **Set Point Adjustment Screw** - Sets the control temperature set point.

D **Normal/Standby switch** - Silences the audible alarm.

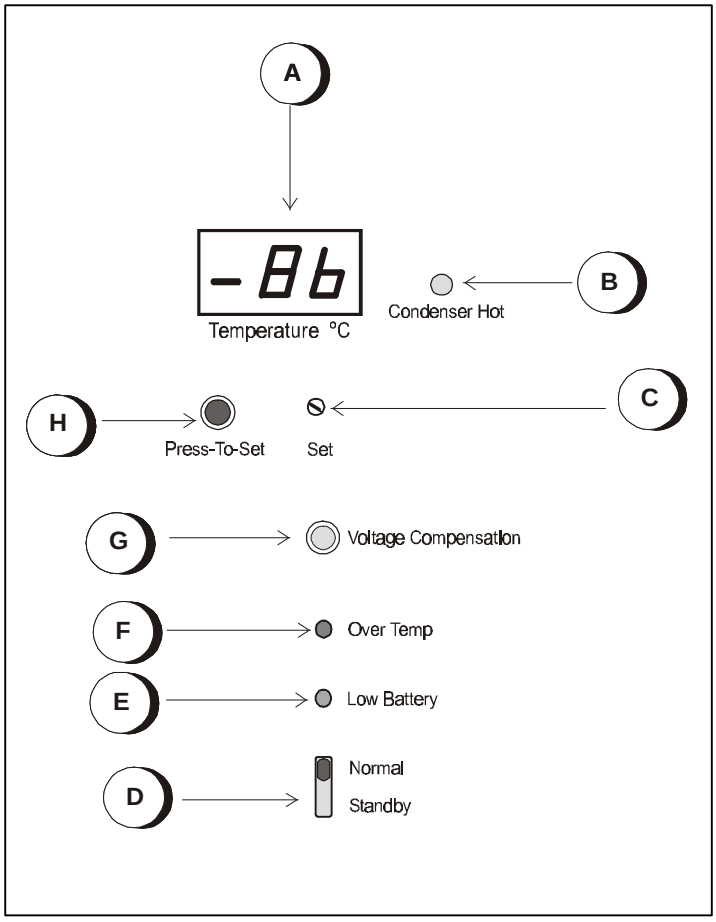

Figure 1-1, Control Panel

E **Low Battery indicator** - Flashes when the battery needs to be replaced.

F **Over Temp indicator** - Flashes when the chamber temperature rises above the Over Temperature Alarm setting.

G **Voltage Compensation indicator -** Indicates when the in-coming electrical power is being automatically adjusted to ensure that the compressor operates within specification.

H **Press-to-Set button -** Press to display control temperature set point.

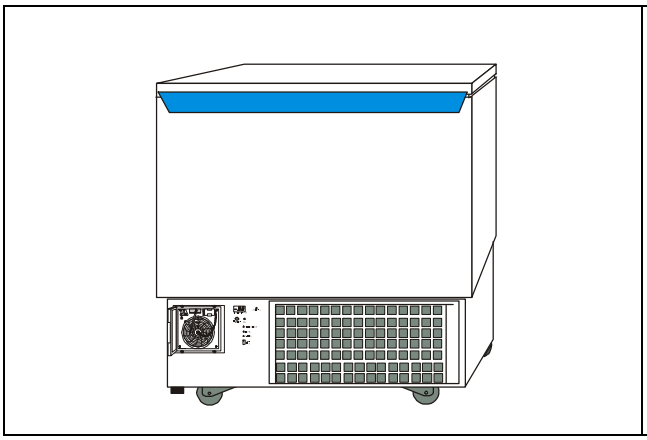

Figure 1-2
3.0 cu. ft. Chest Freezer

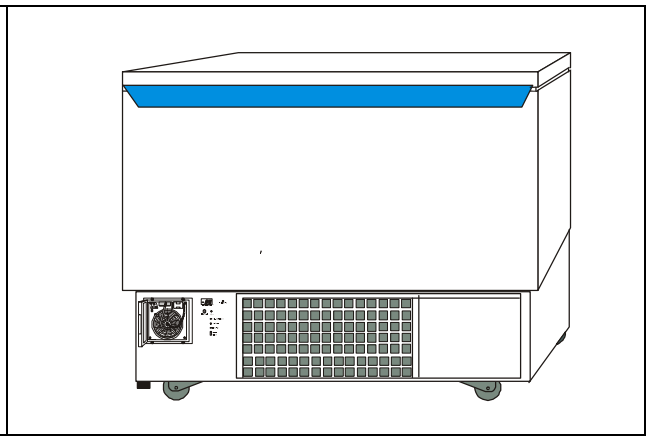

Figure 1-3
6.7 cu. ft. Chest Freezer

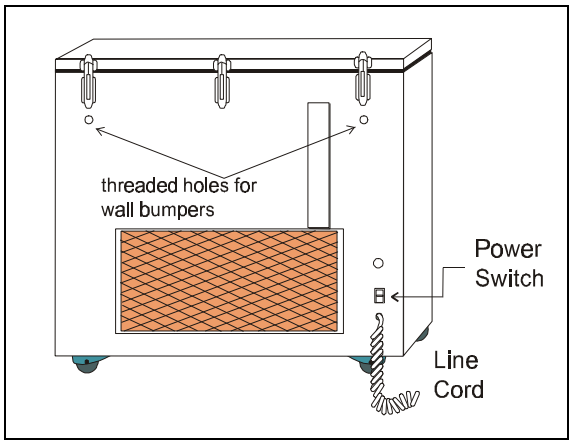

Figure 1-4
Chest Freezer Base, back view

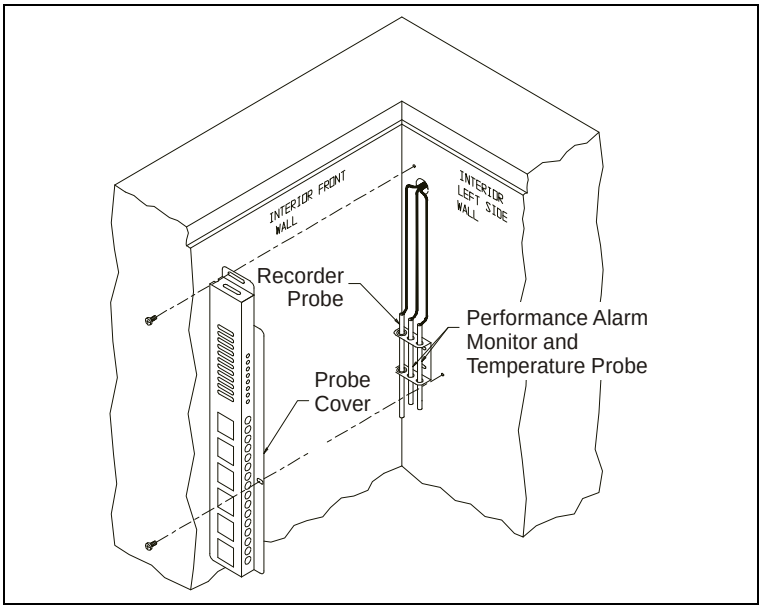

Figure 1-5
Chamber Probe Assembly

1.3 Environmental Conditions

The ULT Freezers are designed to be electrically *safe* in the following environmental conditions:

- Indoors
- Altitude: Up to 2,000 meters
- Temperature: 5°C to 43°C
- Humidity: 80% RH at or below 31°C, decreasing linearly to 50% RH at 40°C
- Mains Supply Fluctuations: ±10% of nominal.
- Installation Category II [1]
- Pollution Degree 2 [2]
- Class of Equipment I
- Climatic Class T (Tropical)[3]

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[1] Installation category (overvoltage category) defines the level of transient overvoltage which the instrument is designed to withstand safely. It depends on the nature of the electricity supply and its overvoltage protection means. For example, in CAT II which is the category used for instruments in installations supplied from a supply comparable to public mains such as hospital and research laboratories and most industrial laboratories, the expected transient overvoltage is 2500V for a 230V supply and 1500V for a 120V supply.

[2] Pollution degree describes the amount of conductive pollution present in the operating environment. Pollution degree 2 assumes that normally only non-conductive pollution such as dust occurs with the exception of occasional conductivity caused by condensation.

[3] Class T (Tropical) means that the freezers are electrically safe in a 43°C ambient.

1.4 Installing the Wall Bumpers (Refer to Figure 1-4)

The parts bag, located inside the cabinet, contains the following parts.

Qty.	Stock #		Description	Purpose
2	224	510016	1/4-20 x 5-1/2" Bolt	Wall Bumper
2	311	380520	Neoprene Cap	Cap Protector

Install the bolts into the pre-tapped holes on the back of the compressor section. Install a neoprene cap on each bolt. Refer to Figure 1-4 for the locations of the pre-tapped holes.

1.5 Location

Locate the freezer on a firm, level surface in an area with an ambient temperature between 18°C and 32°C. Provide ample room to reach the mains disconnect switch (power switch) located on the rear of the freezer.

For proper ventilation and airflow, a minimum of 5" of clear space is required around the freezer.

1.6 Connecting the Alarm Battery

NOTE: The battery must be connected upon start-up so that the alarm will activate during an Overtemperature condition.

1. To gain access to the battery, remove the grill on the front of the freezer. The grill is attached to the freezer by friction plugs on each of the four corners and is readily pulled off. The battery is the rectangle fastened by Velcro to the compressor compartment frame and has a connector with red and black wires. Another red and black wire set with connector is secured to the wiring harness passing through the area of the freezer. Join the two wire connectors and replace the grill.

2. When the battery is connected, the *OVERTEMP* light will flash and the alarm will sound. Turn the N*ORMAL/STANDBY* switch to the *STANDBY* position. This will silence the alarm. The alarm will remain silent until the unit is below alarm setpoint. The alarm setpoint is factory set for -65°C. If another setpoint is required, see Section 2.2.

1.7 Remote Alarm Contacts

Remote alarm contacts are located on the rear of the unit. See Figure 1-6 for pin description, shown in the alarm state. The Forma part number for the plug required is 195482. Maximum rating for this plug is 1.0A @ 30VAC.

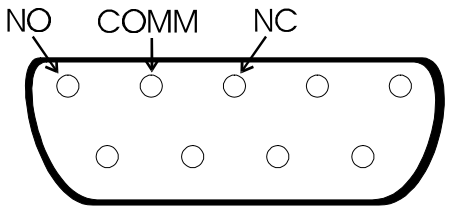


Figure 1-6
Remote Alarm Contact

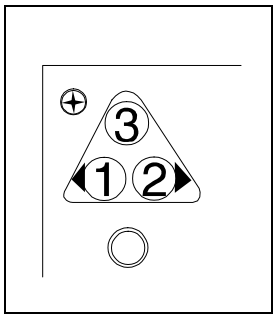
1.8 (Optional) Temperature Recorder

a. Connecting recorder battery

Open the glass door of the recorder and connect the 9-volt battery. The green light on the recorder will come on.

b. Installing the chart paper

1. Open the glass door of the recorder and press button #3 until the pen begins to move outward.
2. Unscrew the knob at the center of the chart and remove the paper.
3. Install the new chart paper, position the paper to the correct time line and replace the knob.
4. Remove the cap from the felt pen and press button #3.



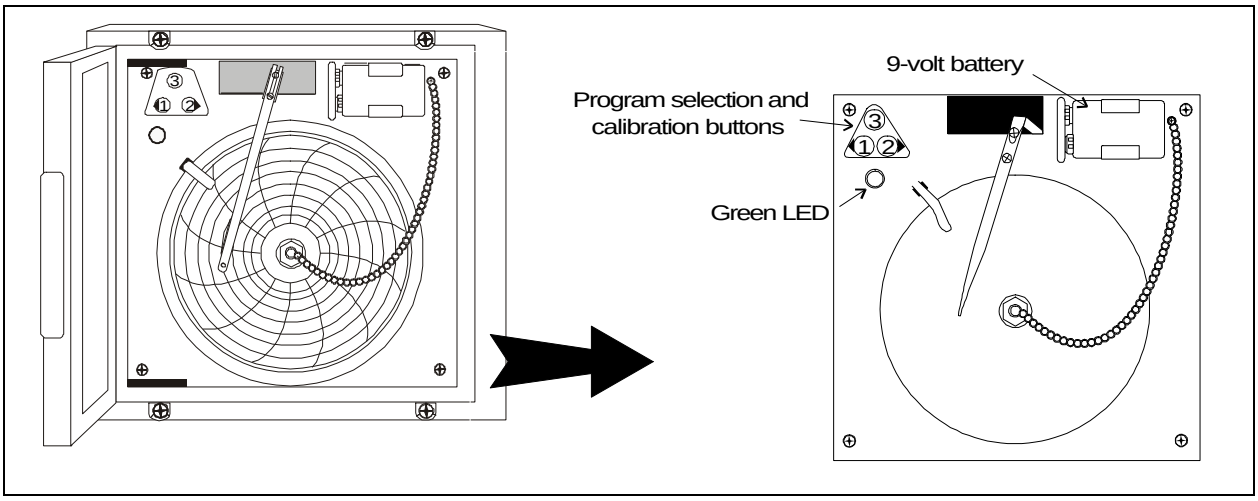


Figure 1-8 Chart Recorder, detail view

1.9 Attaching the Power Cord

1. Loosen screw (A) located on the power cord retainer.
2. Spread the power cord retainer.
3. Insert the power cord into the power outlet module (B).
4. Tighten screw (A) on the power cord retainer.

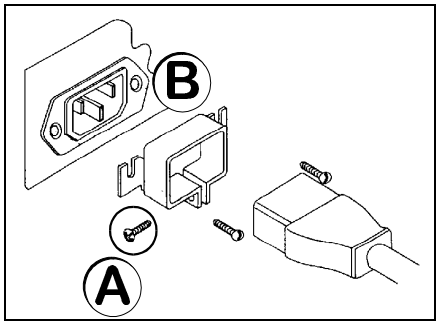


Figure 1-9
Power Cord Assembly

Make sure the power cord connection is completely seated.

1.10 Power Switch (mains disconnect)

The power switch is located on the rear of the unit, directly above the power cord. The power switch is also a circuit breaker that protects the entire unit.

1.11 Electrical Requirement and Connection

- The freezer should be operated on a dedicated grounded service.
- Check voltage rating on the serial tag of the unit and compare it with the outlet voltage.
- With the power switch turned off, plug the line cord into the wall outlet.

1.12 Factory Settings

- Control Temperature – 707 & 771: -80°C
  – 733 & 754: -75°C
- Over Temperature Alarm: -65°C

If you wish to change any of these settings, see the appropriate section(s) in Section 2.

1.13 Start Up and Loading

- Turn the freezer on and allow it to run *empty* overnight.
- When the empty freezer has stabilized overnight at the control temperature set point, load the chamber with pre-frozen product.

The freezer was designed for the storage of pre-frozen product only. The addition of warm product may cause a temporary rise in the cabinet temperature.

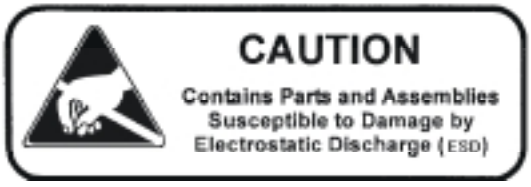
Section 2 – Operation

2.1 Changing the Control Temperature Set Point

1. Remove the screwdriver on the front left corner of the control panel.
2. Press and hold in the PRESS-TO-SET key on the control panel.
3. Using the screwdriver, turn the SETscrew until the desired temperature is displayed. Clockwise lowers the temperature and counter clockwise raises the temperature. The approved operating temperature range for the 707 & 771 is -50°C to -86°C and the range for the 733 & 754 is –50°C to –77°C.

The unit should NEVER be set to operate below the approved operating range. Setting the unit below this range will cause the compressors to operate continuously and reduce compressor life.

2.2 Changing the Over Temp Alarm Set Point



The following procedure sets the alarm for a precise temperature during initial set up. If a precise temperature is not required, set R9 to the desired temperature.

1. Set the unit to operate at the desired alarm point (see Section 2.1) and allow the unit to operate until it reaches the set point.
2. Remove the top two screws securing the control panel and loosen the bottom two screws. Carefully remove the control panel.
3. Remove the six screws securing the cover of the box attached to the inside of the control panel to expose the alarm board.

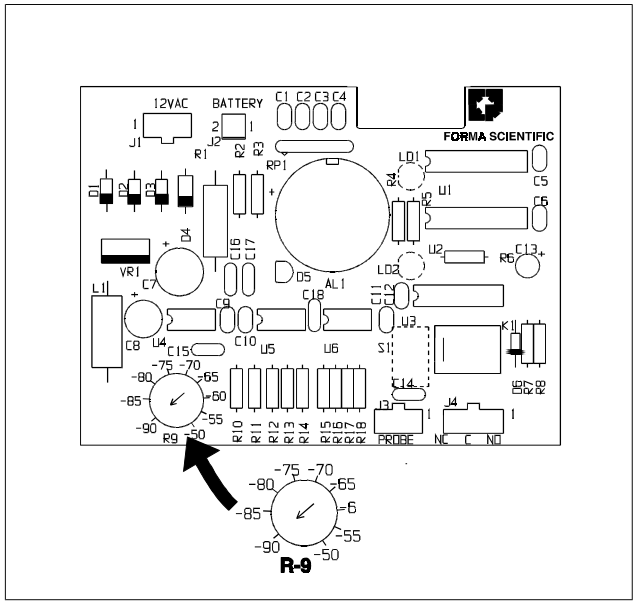


Figure 2-1, Temperature Alarm Circuit Board showing R-9 Control

4. Turn the switch on the control panel to the NORMAL position.

5. If the unit alarms, slowly adjust R9 clockwise (warmer) until the alarm turns off. If the unit is not in alarm, slowly adjust R9 counterclockwise (colder) until the alarm turns on.
6. The alarm is now set for the desired temperature. Reinstall the box cover and secure with screws. Carefully install the control panel to its proper location and secure with screws.
7. Set the unit to the desired control temperature. See Section 2.1.

2.3 Alarms

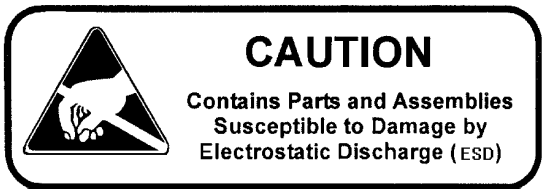
Alarm Description	Visual	Audible	Cause	Action Required
Over Temperature	Flashing (red)	On	• Unit is above alarm setpoint. • Addition of excessive product load	• Check freezer operation.
Condenser Hot	On (red)	---	• Filter and/or condenser dirty. • Operating freezer in greater than 40°C ambient.	• See Section 4.2 and 4.3 for cleaning filter and condenser.
Low Battery	Flashing (red)	---	• Rechargeable battery not connected • Rechargeable battery needs replaced	• See Section 1.6. • Replace battery. See Section 4.7 for battery replacement instructions. See spare parts list for battery part number.
Voltage Compensation	On (green)	---	• Incoming voltage too high or too low	• Check if line voltage is within operating range. See Section 6. If within specs, no action is required.

2.4 Silencing the Over Temperature Alarm

- Move the switch from the NORMAL position to the STANDBY position. When the alarm condition has been corrected, the alarm will sound. The switch must then be returned to the NORMAL position to exit STANDBY mode.

If the unit is left in the STANDBY mode, none of the alarms listed will sound, alarm lights only will turn on.

Section 3 - Calibration



Calibration must be performed when the unit is at operating temperature.

Required equipment: Accurate low-temperature remote bulb thermometer or thermocouple of known accuracy.

3.1 Temperature Display Calibration

Place a measuring device near the probe cover. See Figure 1-5.

1. Allow the unit to stabilize at the operating temperature.
2. Remove the top two screws securing the control panel and loosen the bottom screws.
3. Carefully remove the control panel.
4. Remove the six screws securing the cover of box attached to the inside of the control panel. Remove the cover.
5. Adjust R17 until the control panel display matches the independent measuring device. Several turns of R17 may be required to achieve the desired temperature.
6. Reinstall cover to the box and secure.
7. Check the control temperature set point. Set point may have been altered during the calibration procedure.

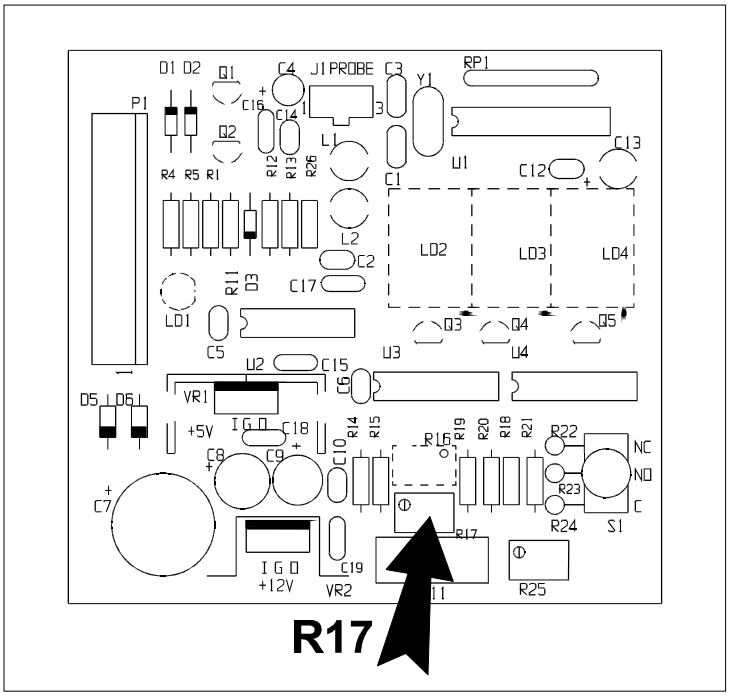


Figure 3-1,
Temperature Control Board showing R-17 Location

3.2 Optional Recorder Calibration

a. Changing the recorder range:

The chart recorder contains eight temperature ranges and is factory-programmed for the freezer.

1. Press and hold button #3 for one second, then let the pen move off of the chart paper.
2. Press and hold for five seconds either button #1 or button #2.
3. Release the button and the green LED will begin to flash. Count the number of flashes to determine the present program setting.
4. To change the program setting, press the left or right arrows to increase or decrease the count.
5. When the desired program number is flashing, press button #3 to bring the pen arm back onto the chart. Recording will begin in the new program.

NOTE: Changing ranges may require an offset calibration as outlined in Section 3.2.b.

Program No.	**Range**		
Program 1	-40°C	to	30°C
Program 2	0°C	to	60°C
Program 3	-100°C	to	38°C
Program 4	-5°C	to	50°C
Program 5	0°C	to	100°C
Program 6	-100°C	to	-200°C
Program 7	-115°C	to	50°C
Program 8	-10°C	to	70°C

Table 3-1
Recorder Range Chart

b. Calibrating the chart recorder:

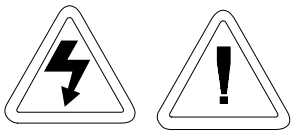
The recorder must be in service for 24 hours before performing the following calibration procedure.

1. Place an accurate thermometer in the chamber next to the recorder probe.
2. Temperature probes for the recorder are located in the left front corner of the freezer chamber (Figure 1-5).
3. After about three minutes, compare the thermometer reading with the chart recorder reading.
4. If an adjustment is necessary, press the #1 button to move the pen to the left or the #2 to move the pen to the right. The button must be held about five seconds before the pen begins to move. Release the button when the pen position matches the thermometer.

NOTE: The felt-tip pen on the recorder requires periodic replacement. Usually the ink will appear to fade before replacement becomes necessary. Additional pen tips may be purchased from Forma Scientific. Refer to Parts List, Section 7. ●

Section 4 - Routine Maintenance

4.1 Cleaning The Cabinet Exterior



Avoid the excessive use of water around the control area due to the risk of electrical shock. Damage to the controls may also result.

1. Wipe down the freezer exterior using soap and water and a general use laboratory disinfectant.
2. Rinse thoroughly with clean water and dry with a soft cloth.

4.2 Cleaning the Air Filter (minimum of twice a year*)

1. Locate the grille on the right side of control panel. See Figure 1-2 or 1-3. Grasp the corner of the grille and gently pull to remove.
2. Remove the filter material and wash, using water and mild detergent.
3. Dry by pressing between two towels.
4. Install the filter back into the grille and attach the grille.

* Depending upon environmental conditions, the filter may need to be cleaned or replaced more frequently. If the filter becomes torn or excessively dirty, a replacement can be purchased from Forma Scientific. See the Parts List, Section 7, for filter part number. A filter kit (set of 5 filters) is also available.

4.3 Cleaning the Condenser (minimum of twice a year*)

1. Locate the grille on the right side of control panel. See Figure 1-2 or 1-3. Grasp the corner of the grille and pull gently to remove.
2. Using a vacuum cleaner, exercising care to not damage the condenser fins, clean the condenser.
3. Install the grille.

* Depending upon environmental conditions, the condenser may need to be cleaned more frequently.

4.4 Defrosting the Chamber

1. Remove all product and place it in another freezer.
2. Turn the unit off and disconnect it from the power source.
3. Turn the Alarm switch to STANDBY, or disconnect the battery.
4. Open all the doors and place towels on the chamber floor.
5. Allow the frost to melt and loosen.
6. Remove the frost with a soft cloth.
7. After defrosting is complete, clean the interior with a non-chloride detergent. Rinse thoroughly with clean water and dry with a soft cloth.
8. Plug unit in and turn power switch on.
9. Allow the freezer to operate *empty* overnight before reloading the product.

4.5 Cleaning the Lid Gasket (minimum monthly*)

1. Using a soft cloth, remove any frost build up from the gasket, sub lids and lid.

*The lid gasket may need to be cleaned more frequently if dirt or excessive frost build-up prevents the door from closing properly.

4.6 Replacing the Battery

For a consistent and dependable charge, replace the battery every 2 years. Replacement batteries must be rechargeable and are available from Forma Scientific. Refer to the parts list for the stock number and description of the replacement batteries.

Dispose of used batteries in a safe manner and in accordance with good environmental practices.

1. Use the power switch and disconnect the line cord from the receptacle to turn the unit off.
2. To gain access to the battery, remove the grill on the front of the freezer. The grill is attached to the freezer by friction plugs on each of the four corners and is readily pulled off. The battery is the rectangle fastened by Velcro to the compressor compartment frame and has a connector with red and black wires. Another red and black wire set with connector is secured to the wiring harness passing through this area of the freezer.
3. Disconnect the two wire connectors, replace the battery pack and secure with the Velcro.
4. Reconnect the battery and replace the grill.
5. Plug unit in and turn power switch on.

4.7 Preparing the Unit for Storage

Defrost the unit as described in Section 4.4. This will prepare the unit for storage. o

The battery must be disconnected to prevent the battery from becoming completely discharged during storage.

Section 5 - Service

4.1 Servicing the Refrigeration System

Servicing must be only performed by service personnel qualified to repair cascade refrigeration systems. Always use standard safety practices when servicing any equipment.

Before opening the refrigeration system, use the troubleshooting chart below to check out the electrical system. Electrical schematics and refrigeration drawings with part numbers are included in this manual.

Symptom	Possible Cause
No Temperature Display.	• Power line cord disconnected or not properly installed. • External power circuit breaker tripped/open. • Main power switch OFF. • 24V transformer fuses open.
Chamber Temperature Deviates from Setpoint.	• Too much warm product added. • Lid open too long. • Inadequate air circulation. • Unit is out of calibration. • Dirty condenser. • High ambient temperature.
Too Much Frost Build-Up.	• Lid not properly sealed
Freezer not Being Refrigerated (Unit is receiving Power).	• Compressor thermal overload open. • Defective temp control. • Defective high pressure cut-off. • Defective compressor(s). • Loss of refrigerant.
Display Problems in General.	• Defective temp control board.
Condenser Hot Light On	• Dirty air filter. • Dirty condenser fan. • Fan failure.

Section 6 - Specifications

3.0 cu. ft. Chest Freezers

	Models 733 and 754
Temperature	-50°C (-58°F) to –77°C (-106°F)
Exterior Dimensions	28.5" W x 41.8" H x 28.8" F-B (72.4cm x 106.2cm x 73.2cm) Add 6.5" (16.5cm) to F-B for handle/wall spacer
Interior Dimensions	18.5" W x 16.5" H x 18.5" F-B (47cm x 41.9cm x 47cm)
Refrigeration	Cascade system, (2) hermetically-sealed compressors
Capacity	3.0 cu. ft. (85 liters)
Insulation	**Type:** Non-CFC urethane **Sides:** 5.0" (12.70cm) **Lid:** 2.0" (5.08cm) **Sub Lid**: 1.0" (2.54cm)
Electrical	**733:** 120 VAC, 1PH, 60 Hz, 10.0 FLA Operating Range: 108VAC - 130VAC **754:** 230 VAC, 1 PH, 50 Hz, 8.0 FLA Operating Range: 208VAC - 240VAC
Breaker Requirements (Dedicated Circuit)	**733:** 15 Amp , 120V **754:** 15 Amp, 230V
Automatic Voltage Compensator	**733:** **Low:** Cut in: 110V, Cut out: 115V, Volts Boost: 10 **High:** Cut in: 125V, Cut out: 120V, Volts Buck: 10 **754:** ***(Compressor only)*** **Low:** Cut in: 95V, Cut out: 100V, Volts Boost: 10 **High:** Cut in: 110V, Cut out: 105V, Volts Buck: 10
Shipping Weight (Non-CFC) Packaging	**Ocean:** 450 lbs. (204 kg) **Air/Container:** 412 lbs. (187 kg) **Motor:** 375 lbs. (170 kg)

6.7 cu. ft. Chest Freezers

	Models 707 and 771
Temperature	-50°C (-58°F) to -86°C (-123°F)
Exterior Dimensions	48" W x 41.8" H x 28.8" F-B (121.9cm x 106.2cm x 73.2cm) Add 6.5" (16.5cm) to F-B for handle/wall spacer
Interior Dimensions	38.0" W x 16.5" H x 18.5" F-B (96.5cm x 41.9cm x 47cm)
Refrigeration	Cascade system, (2) hermetically-sealed compressors
Capacity	6.7 Cu. Ft. (190 liters)
Insulation	**Type:** Non-CFC urethane **Sides:** 5" (12.7 cm) **Lid:** 2" (5.08 cm) **Sub Lid**: 1" (2.54 cm)
Electrical	**707:** 120 VAC, 1PH, 60 Hz, 14 FLA Operating Range: 108VAC - 130VAC **771:** 230 VAC, 1 PH, 50 Hz, 8 FLA Operating Range: 208VAC - 240VAC
Breaker Requirements (Dedicated Circuit)	707: 20 Amp , 120V 771: 15 Amp, 230V
Automatic Voltage Compensator	**Low:** Cut in: 110V, Cut out: 115V, Volts Boost: 10 Cut in: 210V, Cut out: 220V, Volts Boost: 18 **High:** Cut in: 125V, Cut out: 120V, Volts Buck: 10 Cut in: 235V, Cut out: 225V, Volts Buck: 18
Shipping Weight (Non-CFC) Packaging	**Ocean:** 600 lbs. (272 kg) **Air/Container:** 565 lbs. (256 kg) **Motor:** 492 lbs. (223 kg)

Section 7 - Parts List

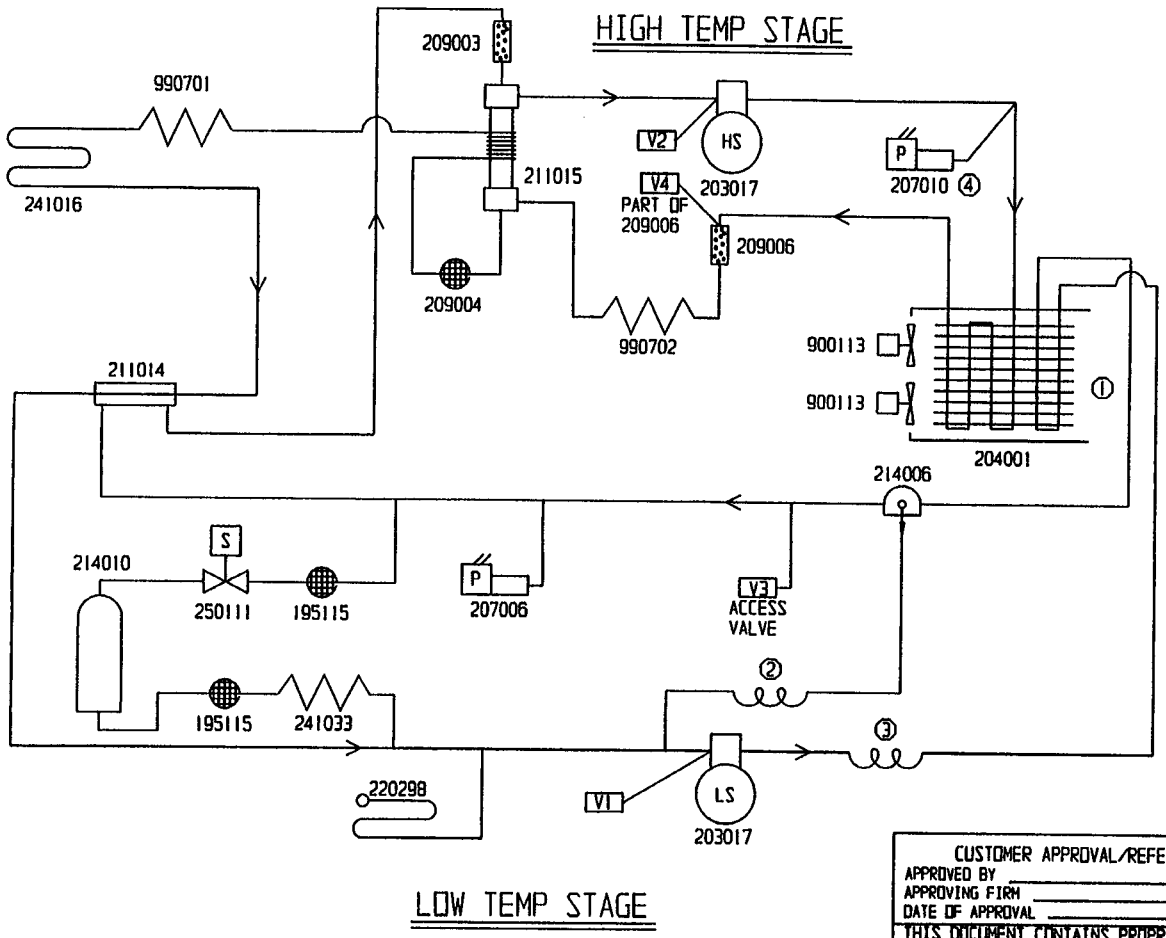
Models 733 and 754 (3.0 cu. ft. models)

Stock #	Qty	Description
191627	1	Temperature Control Board
195383	1	Thermostat 40°C
290165	1	Temperature Monitor Probe
400116	1	Battery, Dryseal pack 3.6V, AA
214006	1	Oil Separator
209003	1	Dryer 3/8 ODF
209006	1	Dryer 1/4 ODS
250111	1	Solenoid Valve, 120V
207010	1	Pressure Switch, Cutout (high pressure cut-out @ 350 PSIG)
900113	1	Tubeaxial Fan, 120V
760198	1	Air Filter, 11.4” x 14.4”
230110	2	1.0 Amp Fuse, Slo-Blow (Transformer)
420101	1	Transformer, 25 VA, 24Volt
1990150	1	Low Stage Compressor with Zerol 150T, 120V,1/4 HP (Models 733 & 754)
2990150	1	High Stage Compressor with Ester Oil, 120V, 1/4 HP (Models 733 & 754)
970023	70# cyl	Refrigerant R-134A, High Stage
970022	70# cyl	Refrigerant R-23, Low Stage
970009	14.5 oz	Propane
970010	1	Propane Tank Adapter
143021	1 gal	Zerol 150T

Models 707 and 771 (6.7 cu. ft. models)

Stock #	Qty	Description
191627	1	Temperature Control Board
195383	1	Thermostat 40°C
290165	1	Temperature Monitor Probe
400116	1	Battery, Dryseal pack 3.6V, AA
214006	1	Oil Separator
209003	1	Dryer 3/8 ODF
209006	1	Dryer 1/4 ODS
250111	1	Solenoid Valve, 120V
250115	1	Solenoid Valve (230V models only)
207010	1	Pressure Switch, Cutout (high pressure cut-out @ 350 PSIG)
900113	2	Tubeaxial Fan, 120V (Model 707)
900111	2	Tubeaxial Fan, 230V (Model 771)
760165	1	Air Filter, 11.4” x 25.9”
195519	1	(5) 760165 Air Filters
230110	2	1.0 Amp Fuse, Slo-Blow (Transformer)
420101	1	Transformer, 25 VA, 24Volt
1990209	1	Low Stage Compressor with Zerol 150T, 230V, 1/3 HP (Model 771)
2990209	1	High Stage Compressor with Ester Oil, 230V, 1/3 HP (Model 771)
1203017	1	Low Stage Compressor with Zerol 150T, 120V, 1/3 HP (Model 707)
2203017	1	High Stage Compressor with Ester Oil, 120V, 1/3 HP (Model 707)
970023	70# cyl	Refrigerant R-134A, High Stage
970022	70# cyl	Refrigerant R-23, Low Stage
970009	14.5 oz	Propane
970010	1	Propane Tank Adapter
143021	1 gal	Zerol 150T

Section 8 - Refrigeration Drawings



CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE:
REFRIGERANT R-134a: 482 gr (17 OZ)
MOBIL EAL-22: COMPRESSOR 567 gr (20 OZ)
④MODELS 707 & 5476 ONLY

LOW TEMPERATURE STAGE:
*REFRIGERANT R-290: 14 gr (0.5 OZ) (30" VAC. - 0 PSIG)
*REFRIGERANT R-23: 164 gr (5.8 OZ) (0 PSIG - 80 PSIG)
ZEROL 150T: (COMPRESSOR) 567 gr (20 OZ)
(OIL SEPARATOR) 425 (15 OZ)
DESUPER HEAT COIL: ①TOP FOUR PASSES OF R-12 AIR-COOLED CONDENSER
VIB. ISO. COIL ② 1 COIL 1/4" TUBING X 4" DIA.
DESUPER HEAT/VIB. ISO. COIL ③ 2 COILS 5/16" TUBING X 6-3/4" DIA.

*WHEN SYSTEM IS AT 24°C

CUSTOMER APPROVAL/REFERENCE
APPROVED BY
APPROVING FIRM
DATE OF APPROVAL

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REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
2	N/A	12-20-99	LDC	LDC	CBL	REVISED FOR UL/CSA LISTING
1	FR-1203	04-10-98	RLM	KDG	LDN	ADDED METRIC UNITS FOR IEC-1010
0	N/A	10-29-97	AT	AT	CBL	RELEASED FOR PRODUCTION

DATE 10-29-97	DWN AT		CAD AT	APPD CBL	SCALE NONE
CUSTOMER					
JOB TITLE	6.7 CUFT CHEST FREEZER (5407, 5476)				
DWG TITLE	REFRIGERATION SCHEMATIC				
LOCATION		JOB NUMBER		DRAWING NUMBER	707-90-0-B

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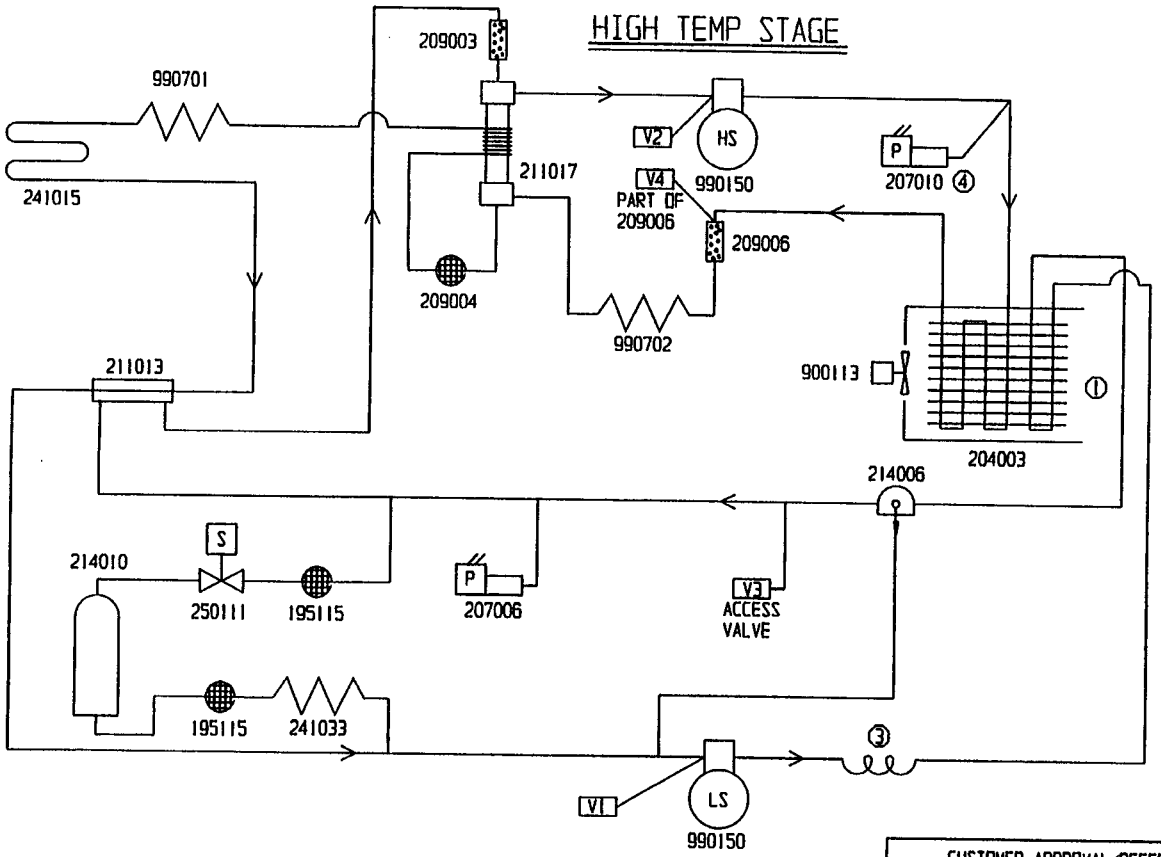

CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE:
REFRIGERANT R-134a: 482 gr (17 OZ)
MOBIL EAL-22: COMPRESSOR 567 gr (20 OZ)
④MODELS 733, 754, 5473 & 5474 ONLY

LOW TEMPERATURE STAGE:
*REFRIGERANT R-290: 14 gr (0.5 OZ) (30" VAC. - 0 PSIG)
*REFRIGERANT R-23: 159 gr (5.6 OZ) (0 PSIG - 80 PSIG)
ZEROL 150T: (COMPRESSOR) 567 gr (20 OZ)
(OIL SEPARATOR) 425 gr (15 OZ)
DESUPER HEAT COIL: ①TOP FOUR PASSES OF R-134a
AIR-COOLED CONDENSER

DESUPER HEAT/VIB. ISO. COIL ③ 3 COILS 1/4" TUBING X 5" DIA.

*WHEN SYSTEM IS AT 24°C

CUSTOMER APPROVAL/REFERENCE
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0	N/A	10-29-97	AT	AT	CBL	RELEASED FOR PRODUCTION

DATE 10-29-97	DWN AT		CAD AT	APPD CBL	SCALE NONE
CUSTOMER					
JOB TITLE	3 CUFT CHEST FREEZER (754,5433,5454,5473,5474)				
DWG TITLE	REFRIGERATION SCHEMATIC				
LOCATION		JOB NUMBER		DRAWING NUMBER	733-90-0-B

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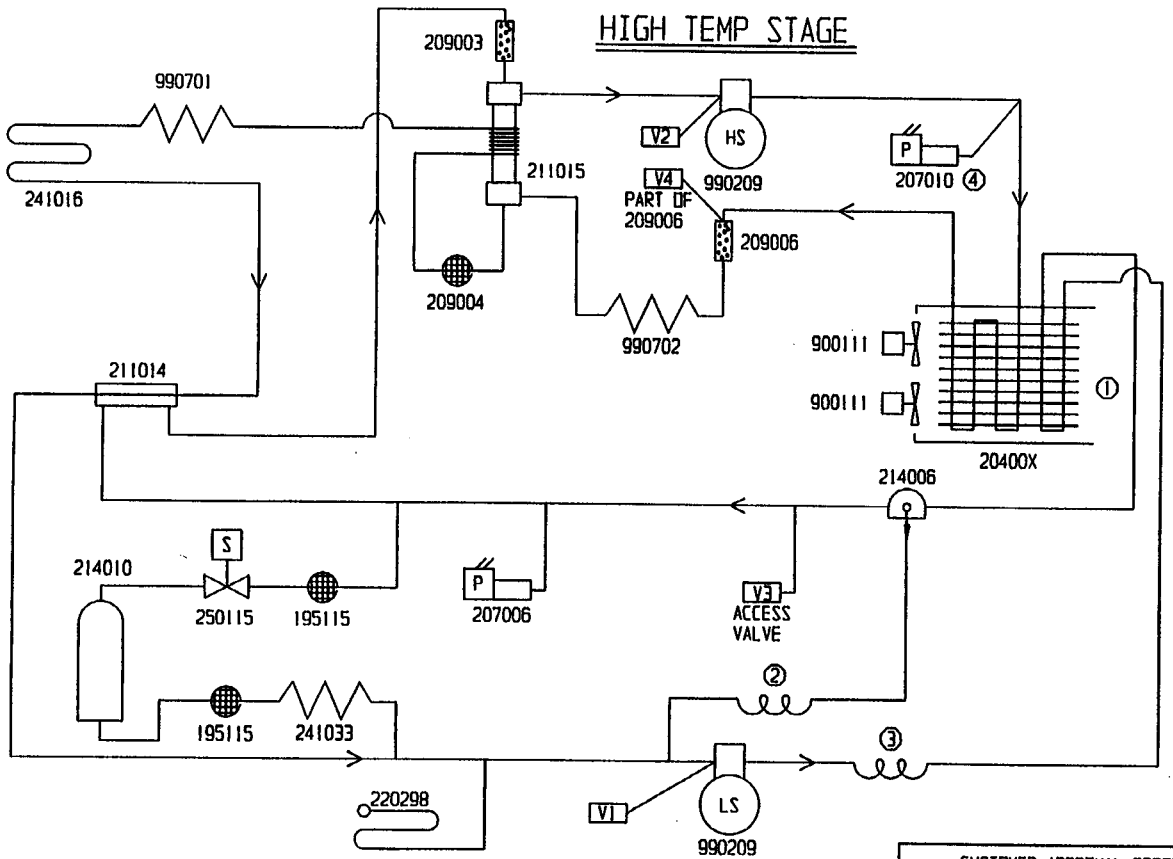

CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE:
REFRIGERANT R-134a: 482 gr (17 OZ)
MOBIL EAL-22: COMPRESSOR 567 gr (20 OZ)
④ MODELS 771 & 5477 ONLY

LOW TEMPERATURE STAGE:
*REFRIGERANT R-290: 14 gr (0.5 OZ) (30" VAC. - 0 PSIG)
*REFRIGERANT R-23: 164 gr (5.8 OZ) (0 PSIG - 80 PSIG)
ZEROL 150T: (COMPRESSOR) 567 gr (20 OZ)
(OIL SEPARATOR) 425 gr (15 OZ)
DESUPER HEAT COIL: ① TOP FOUR PASSES OF R-12 AIR-COOLED CONDENSER
VIB. ISO. COIL ② 1 COIL 1/4" TUBING X 4" DIA.
DESUPER HEAT/VIB. ISO. COIL ③ 2 COILS 5/16" TUBING X 6-3/4" DIA.

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0	N/A	10-29-97	AT	AT	CBL	RELEASED FOR PRODUCTION

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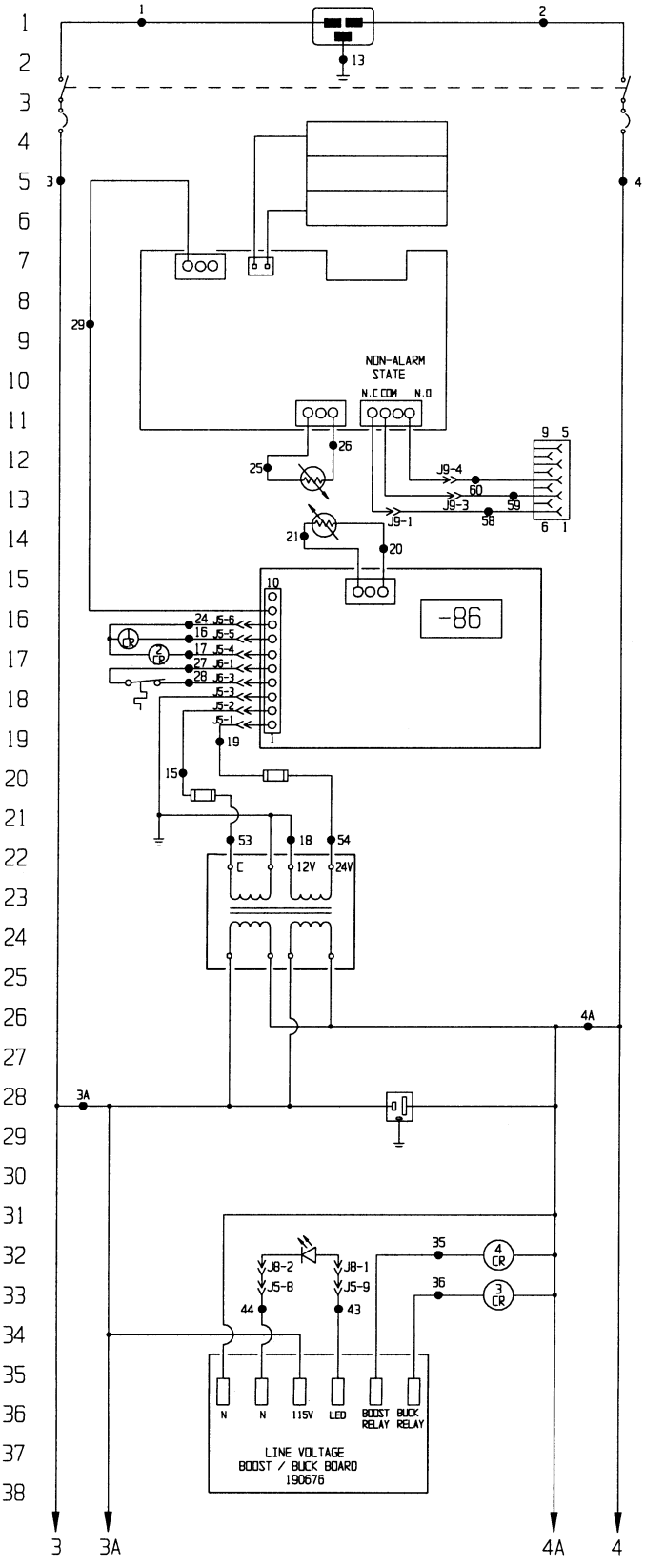
DATE 10-29-97	DWN AT	CAD AT	APPD CBL / SCALE NONE
CUSTOMER			
JOB TITLE	6.7 CUFT CHEST FREEZER (5408, 5477)		
DWG TITLE	REFRIGERATION SCHEMATIC		
LOCATION	JOB NUMBER	DRAWING NUMBER	771-90-0-B

Section 9 - Electrical Schematics

POWER CONNECTION
120V, 1Ø, 2W, 60HZ, 14.0 FLA
(OPERATING RANGE 108-130)



460169
POWER INLET

230184
15A CIRCUIT BREAKER/SWITCH

400116
BATTERY PACK

190891
ALARM BOARD

290165 PROBE
1000 OHM PLATINUM

REMOTE ALARM CONTACTS

290165 PROBE
1000 OHM PLATINUM

191627
TEMP. CONTROL BOARD

300261
HIGH STAGE RELAY 54

300261
LOW STAGE RELAY 64

195383
AIR FLOW T-STAT
OPEN ON RISE

230110
1A, 250V SLO BLOW FUSE

420101
TRANSFORMER 24VCT, 25VA

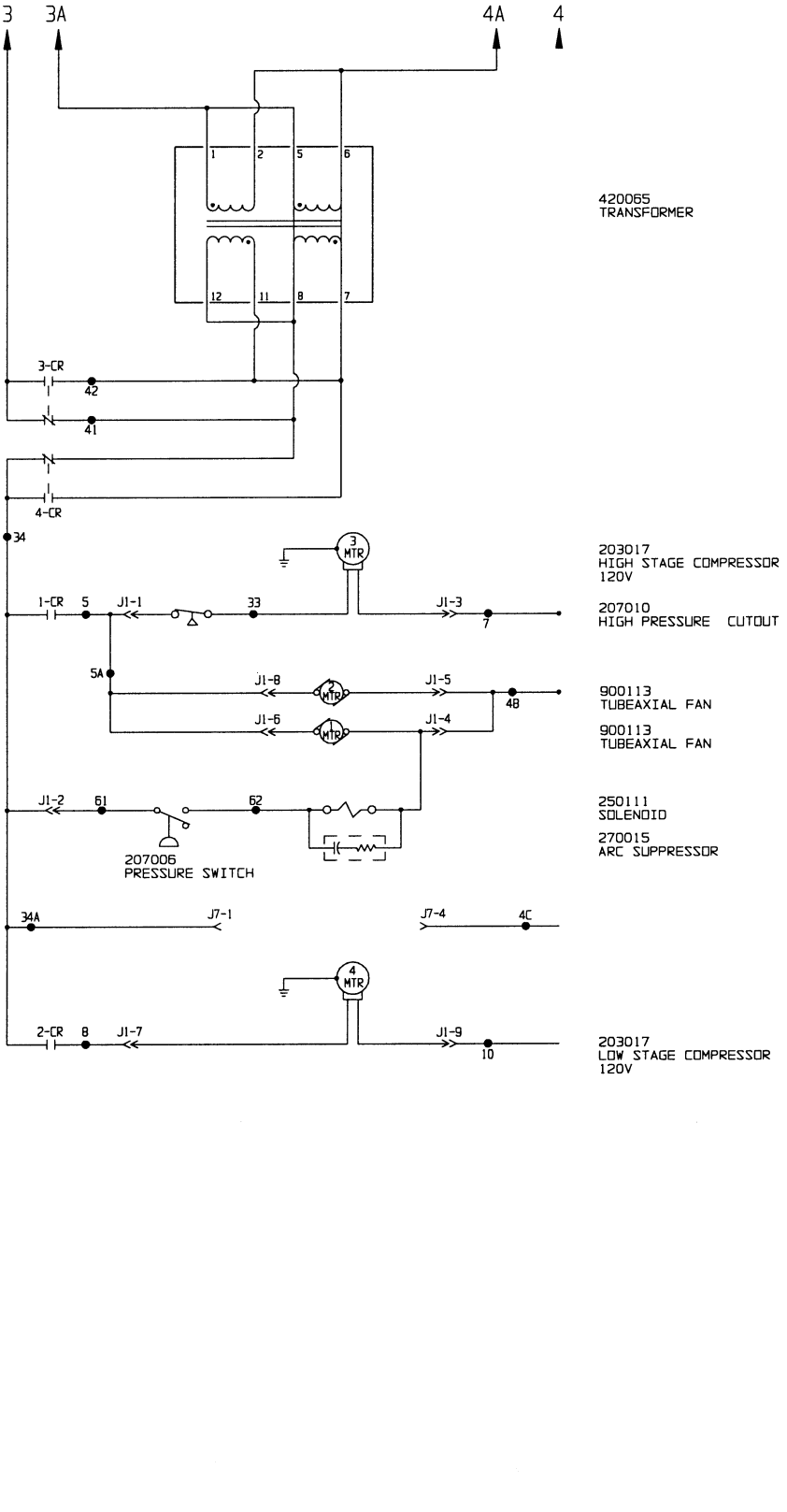
460024
RECORDER OUTLET

195382
VOLTAGE CORRECTION LED

300073
BOOST RELAY
50, 51

300073
BUCK RELAY
48, 49

Electrical Schematic
Forma Model:
707, 5476
6.7 cu. ft. ULT
Chest Freezer



Electrical Schematic
Forma Model:
707, 5476
6.7 cu. ft. ULT
Chest Freezer

WIRE REFERENCE CHART

WIRE #	GAUGE	COLOR
1	14	BRN
2	14	BLU
3	14	BLK
3A	14	BLK
4	14	BLU
4A	18	BLU
4B	18	BLU
4C	18	BLU
5	14	BRN
5A	18	BRN
7	14	YEL
8	14	BLK
10	14	ORG
13	14	GRN/YEL
15	22	RED
16	22	YEL
17	22	ORG
18	22	BLK
19	22	WHT
20	22	RED
21	22	WHT
24	22	BLU
25	22	RED

WIRE REFERENCE CHART

WIRE #	GAUGE	COLOR
26	22	WHT
27	22	BLK
28	22	BLK
29	22	BLK
33	14	BRN
34	14	BRN
34A	18	BRN
35	18	ORG
36	18	YEL
41	14	RED
42	14	GRY
43	18	RED
44	18	BLU
53	22	RED
54	22	WHT
58	24	RED
59	24	BLK
60	24	WHT
61	18	BLK
62	18	BRN

REMOTE CONTACTS
PIN# 1 NORMALLY CLOSED
PIN# 2 COMMON
PIN# 3 NORMALLY OPEN

CONTACT RATING: 1A @ 30V

NOTES:

⊛	Denotes Terminal Strip Connection	Parts List Reference Number	
4-CR	Last Relay Number	○	Assembly
N/A	Last Terminal Number	⬠	Panel
62	Last Wire Number	○	Refrigeration
		□	Wiring

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

CUSTOMER APPROVAL/REFERENCE
APPROVED BY _____
APPROVING FIRM _____
DATE OF APPROVAL _____

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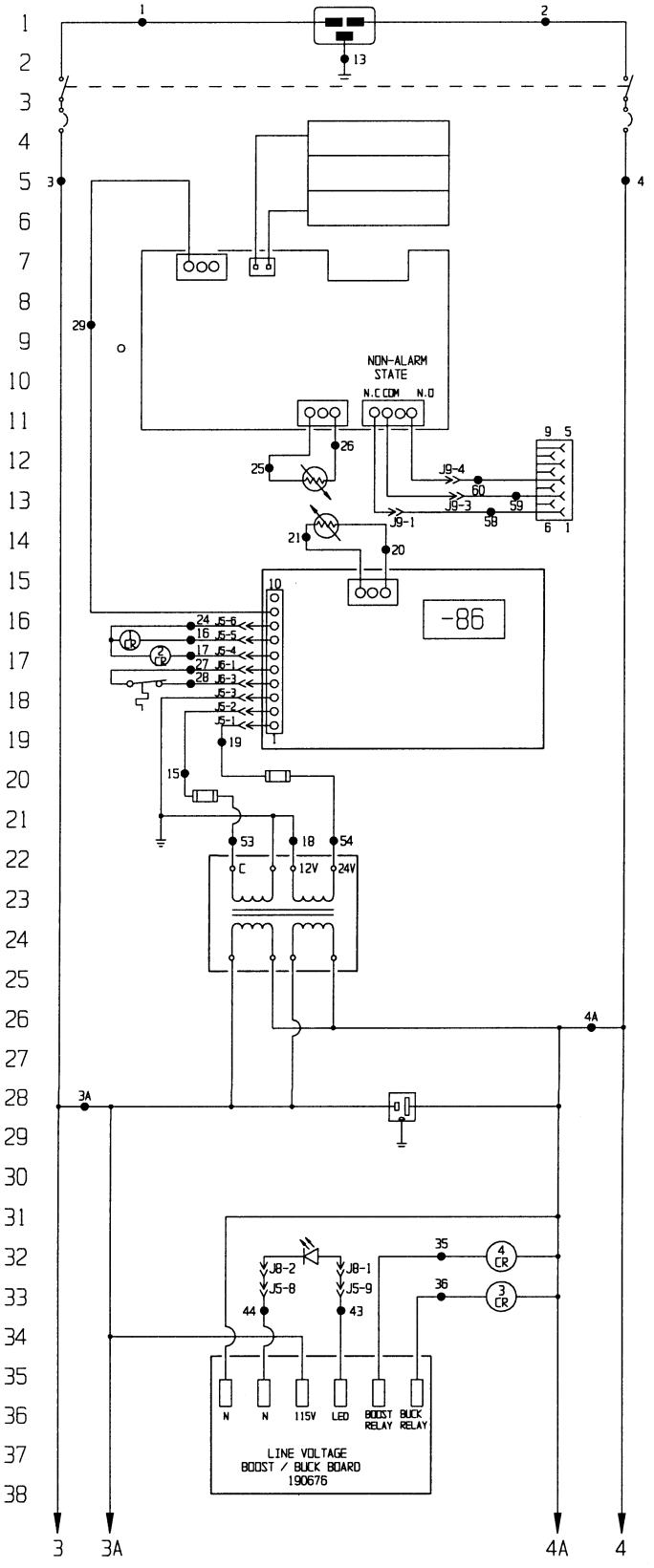
REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
3	FR-1402	05-24-00	AT	GLS	LDN	REVISED ALARM BD PWR CONNECTION
2	FR-1357	11-22-99	AT	AT	LDN	EMC UPDATES
1	FR-1223	06-04-98	AT	KDG	LDN	CHG'D. TEMP. BOARD 190764 TO 190829
0	N/A	10-29-97	AT	AT	CBL	RELEASED FOR PRODCTION

DATE 10-29-97 | DWN AT | CAD AT | APPD CBL | SCALE NONE
CUSTOMER
JOB TITLE 6.7 CUFT CHEST ULT FREEZER (707, 5476)
DWG TITLE ELECTRICAL SCHEMATIC
LOCATION | JOB NUMBER | DRAWING NUMBER 707-70-0-D

Electrical Schematic
Forma Model:
707, 5476
6.7 cu. ft. ULT
Chest Freezer

707-70-0-D REV. 3

POWER CONNECTION
120V, 1Ø, 2W, 60HZ, 10.0 FLA
(OPERATING RANGE 108-130)



460169
POWER INLET

230184
15A CIRCUIT BREAKER/SWITCH

400116
BATTERY PACK

190891
ALARM BOARD

290165 PROBE
1000 OHM PLATINUM

REMOTE ALARM CONTACTS

290165 PROBE
1000 OHM PLATINUM

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HIGH STAGE RELAY 54

300261
LOW STAGE RELAY 64

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AIR FLOW T-STAT
OPEN ON RISE

230110
1A, 250V SLO BLOW FUSE

420101
TRANSFORMER 24VCT, 25VA

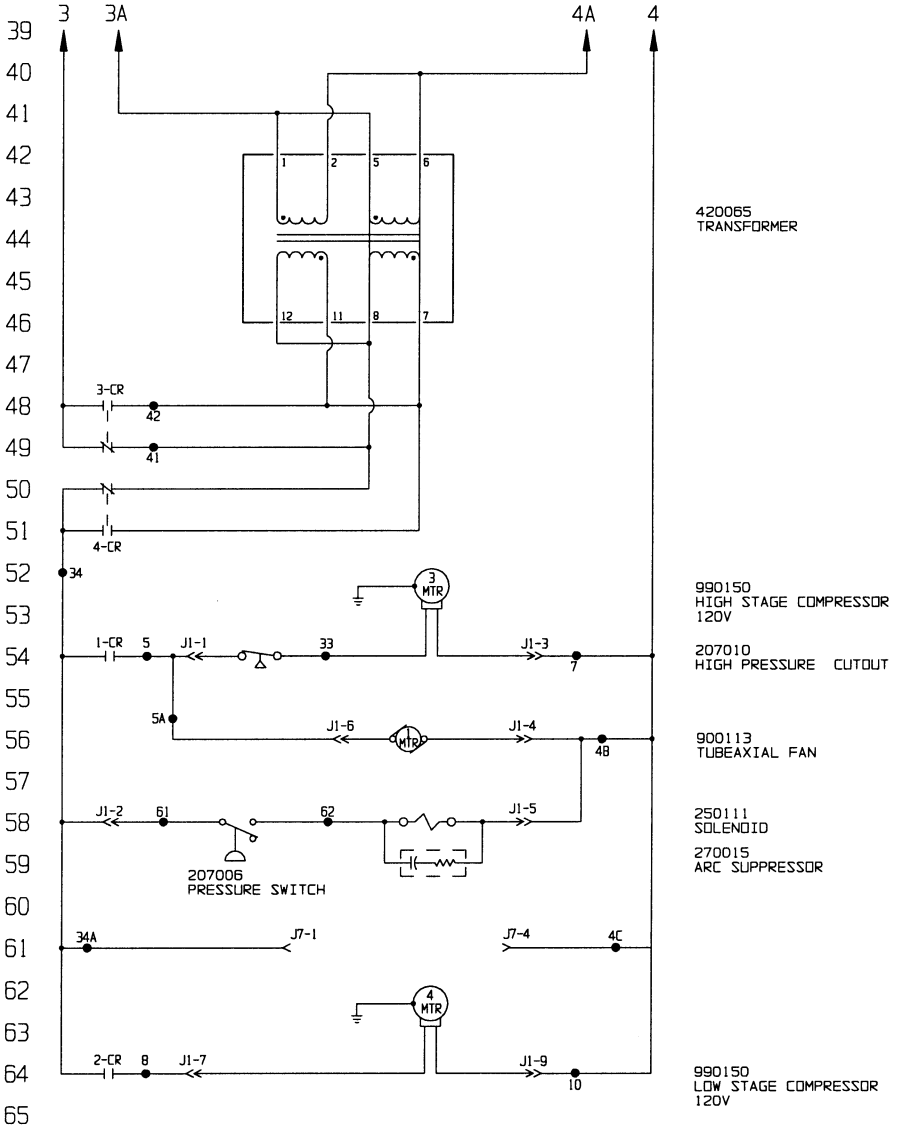
460024
RECORDER OUTLET

195382
VOLTAGE CORRECTION LED

300073
BOOST RELAY
50, 51

300073
BUCK RELAY
48, 49

Electrical Schematic
Forma Model:
733, 5473
3.0 cu. ft. ULT
Chest Freezer



Electrical Schematic Forma Model: 733, 5473 3.0 cu. ft. ULT Chest Freezer
733-70-0-D REV. 3 Page 2 of 3

WIRE REFERENCE CHART

WIRE #	GAUGE	COLOR
1	14	BRN
2	14	BLU
3	14	BLK
3A	14	BLK
4	14	BLU
4A	18	BLU
4B	18	BLU
4C	18	BLU
5	14	BRN
5A	18	BRN
7	14	YEL
8	14	BLK
10	14	ORG
13	14	GRN/YEL
15	22	RED
16	22	YEL
17	22	ORG
18	22	BLK
19	22	WHT
20	22	RED
21	22	WHT
24	22	BLU
25	22	RED

WIRE REFERENCE CHART

WIRE #	GAUGE	COLOR
26	22	WHT
27	22	BLK
28	22	BLK
29	22	BLK
33	14	BRN
34	14	BRN
34A	18	BRN
35	18	ORG
36	18	YEL
41	14	RED
42	14	GRY
43	18	RED
44	18	BLU
53	22	RED
54	22	WHT
58	24	RED
59	24	BLK
60	24	WHT
61	18	BLK
62	18	BRN

REMOTE CONTACTS
PIN# 1 NORMALLY CLOSED
PIN# 2 COMMON
PIN# 3 NORMALLY OPEN

CONTACT RATING: 1A @ 30V

NOTES:

⊛	Denotes Terminal Strip Connection	Parts List Reference Number	
4-CR	Last Relay Number	○	Assembly
N/A	Last Terminal Number	⬠	Panel
62	Last Wire Number	⬡	Refrigeration
		□	Wiring

ATTENTION
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CUSTOMER APPROVAL/REFERENCE
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DATE OF APPROVAL

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REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
3	FR-1402	05-24-00	AT	GLS	LDN	REVISED ALARM BD POWER CONNECTION
2	FR-1357	11-22-99	AT	AT	LDN	EMC UPDATES
1	FR-1223	06-04-98	AT	KDG	LDN	CHG'D. TEMP. BOARD 190764 TO 190829
0	N/A	10-29-97	AT	AT	CBL	RELEASED FOR PRODCTION

DATE 10-29-97 | DWN AT | CAD AT | APPD CBL | SCALE NONE

CUSTOMER

JOB TITLE 3.0 CUFT CHEST ULT FREEZER (733, 5473)

DWG TITLE ELECTRICAL SCHEMATIC

LOCATION | JOB NUMBER | DRAWING NUMBER 733-70-0-D

Forma Scientific
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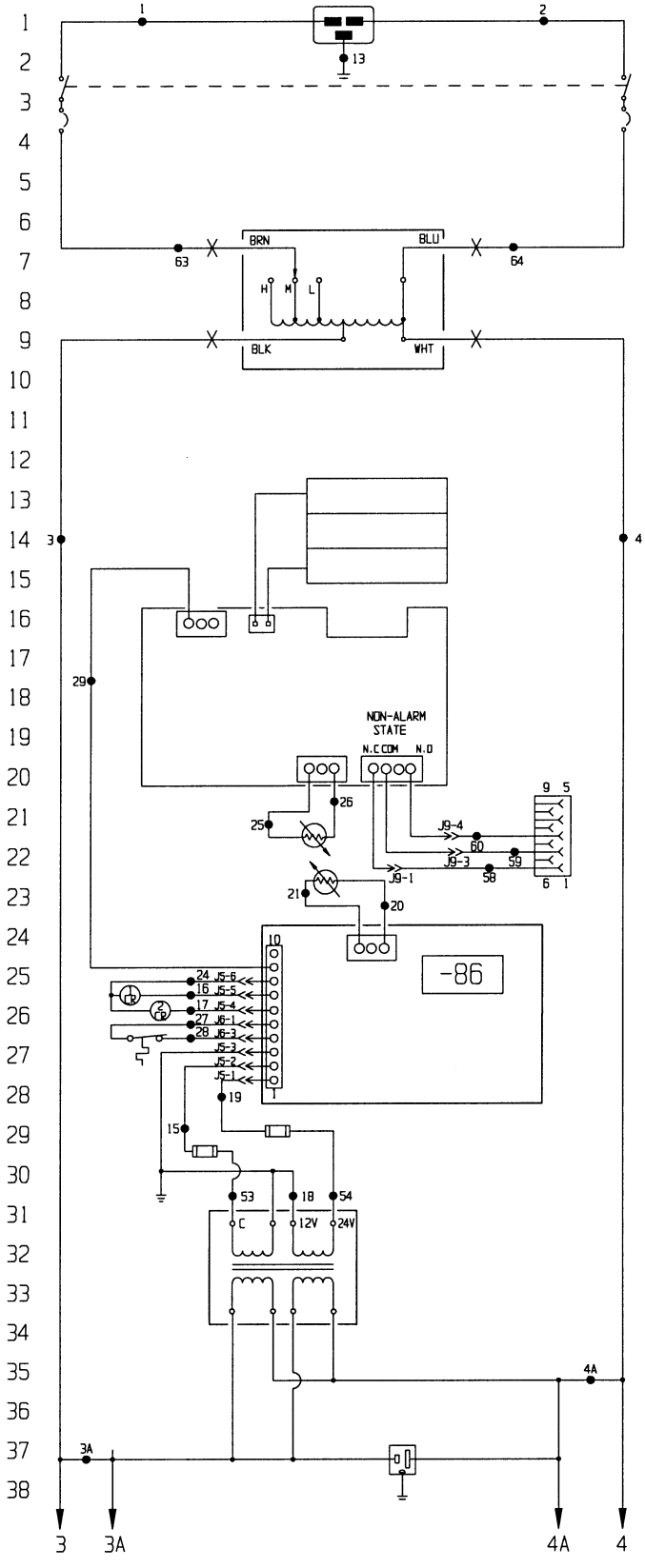
TOLL FREE USA 800-848-3080, OHIO 740-373-4763

Electrical Schematic
Forma Model:
733, 5473
3.0 cu. ft. ULT
Chest Freezer

733-70-0-D REV. 3

POWER CONNECTION
230V, 1Ø, 2W, 50HZ,8.0 FLA
(OPERATING RANGE 208-240)



460169
POWER INLET

230178
8A CIRCUIT BREAKER/SWITCH

280043
AUTO-TRANSFORMER 1.5KV
FACTORY SET ON MEDIUM TAP

400116
BATTERY PACK

190891
ALARM BOARD

290165 PROBE
1000 OHM PLATINUM

REMOTE ALARM CONTACTS

290165 PROBE
1000 OHM PLATINUM

191627
TEMP. CONTROL BOARD

300261
HIGH STAGE RELAY 61

300261
LOW STAGE RELAY 71

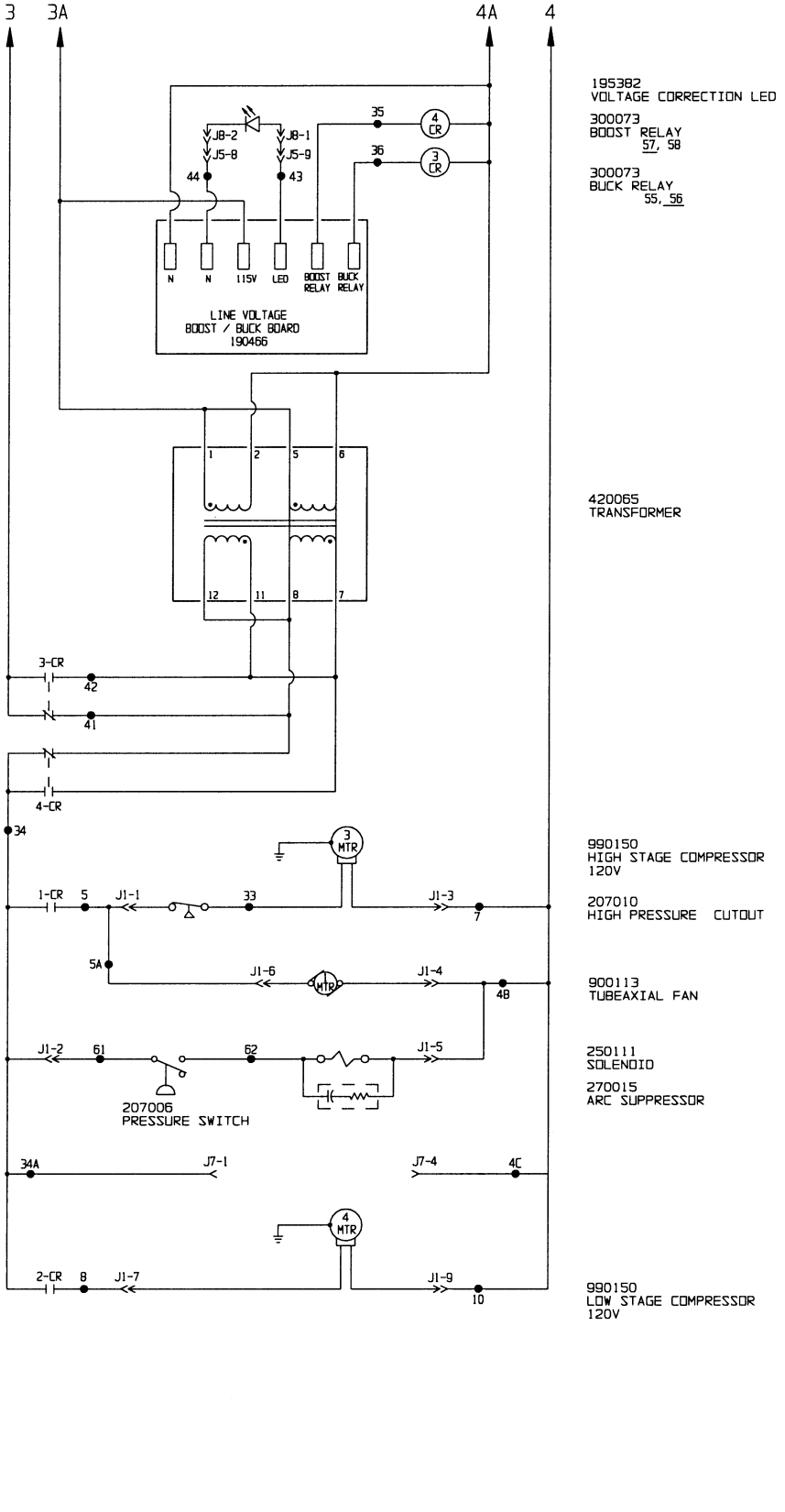
195383
AIR FLOW T-STAT
OPEN ON RISE

230110
1A, 250V SLO BLOW FUSE

420101
TRANSFORMER 24VCT, 25VA

460024
RECORDER OUTLET

Electrical Schematic
Forma Model:
754, 5474
3.0 cu. ft. ULT
Chest Freezer



Electrical Schematic
Forma Model:
754, 5474
3.0 cu. ft. ULT
Chest Freezer

WIRE REFERENCE CHART

WIRE #	GAUGE	COLOR
1	14	BRN
2	14	BLU
3	14	BLK
3A	14	BLK
4	14	BLU
4A	18	BLU
4B	18	BLU
4C	18	BLU
5	14	BRN
5A	18	BRN
7	14	YEL
8	14	BLK
10	14	ORG
13	14	GRN/YEL
15	22	RED
16	22	YEL
17	22	ORG
18	22	BLK
19	22	WHT
20	22	RED
21	22	WHT
24	22	BLU
25	22	RED

WIRE REFERENCE CHART

WIRE #	GAUGE	COLOR
26	22	WHT
27	22	BLK
28	22	BLK
29	22	BLK
33	14	BRN
34	14	BRN
34A	18	BRN
35	18	ORG
36	18	YEL
41	14	RED
42	14	GRY
43	18	RED
44	18	BLU
53	22	RED
54	22	WHT
58	24	RED
59	24	BLK
60	24	WHT
61	18	BLK
62	18	BRN
63	14	BRN
64	14	BLU

REMOTE CONTACTS
PIN# 1 NORMALLY CLOSED
PIN# 2 COMMON
PIN# 3 NORMALLY OPEN

CONTACT RATING: 1A @ 30V

NOTES:

⊛	Denotes Terminal Strip Connection		Parts List Reference Number
4-CR	Last Relay Number	○	Assembly
N/A	Last Terminal Number	⬠	Panel
64	Last Wire Number	⬡	Refrigeration
		□	Wiring

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

CUSTOMER APPROVAL/REFERENCE
APPROVED BY _____
APPROVING FIRM _____
DATE OF APPROVAL _____

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Forma Scientific
BOX 649 MARIETTA, OHIO 45750
TOLL FREE USA 800-848-3080, OHIO 740-373-4763

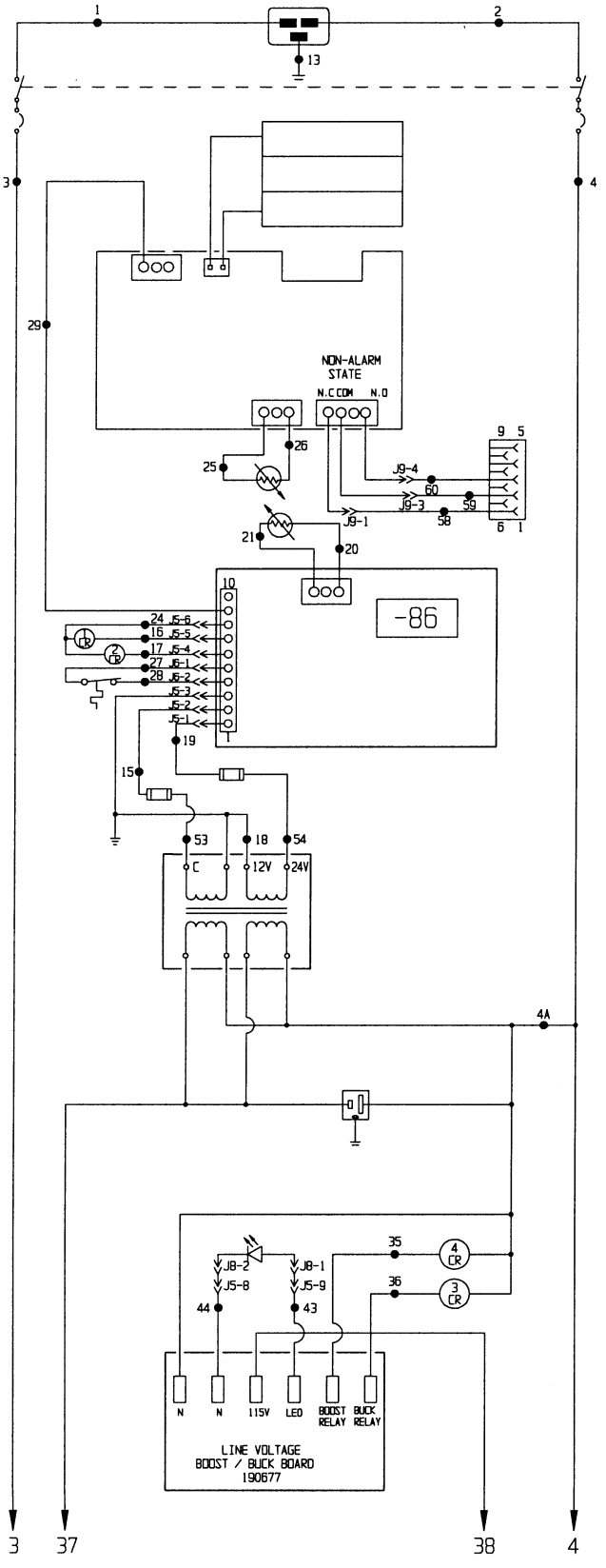
REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
4	FR-1402	05-24-00	AT	GLS	LDN	REVISED ALARM BD PWR CONNECTION
3	FR-1357	12-1-99	AT	AT	LDN	EMC UPDATES
2	FR-1223	06-04-98	AT	KDG	LDN	CHG'D. TEMP. BOARD 190764 TO 190829
1	FR-1146	02-12-98	AT	KDG	LDN	CORRECT 9.0 FLA TO 8.0 FLA
0	N/A	10-29-97	AT	AT	CBL	RELEASED FOR PRODCTION

DATE 10-29-97	DWN AT		CAD AT	APPD CBL	SCALE NONE
CUSTOMER					
JOB TITLE 3.0 CUFT CHEST ULT FREEZER (754, 5474)					
DWG TITLE ELECTRICAL SCHEMATIC					
LOCATION		JOB NUMBER		DRAWING NUMBER 754-70-0-D	

Electrical Schematic
Forma Model:
754, 5474
3.0 cu. ft. ULT
Chest Freezer

754-70-0-D REV. 4

POWER CONNECTION
230V, 1Ø, 2W, 50/60HZ, 8.0 FLA
(OPERATING RANGE 208-240)



460169
POWER INLET

230184
15A CIRCUIT BREAKER/SWITCH

400116
BATTERY PACK

190891
ALARM BOARD

290165 PROBE
1000 OHM PLATINUM

REMOTE ALARM CONTACTS

290165 PROBE
1000 OHM PLATINUM

191627
TEMP. CONTROL BOARD

300261
HIGH STAGE RELAY 54

300261
LOW STAGE RELAY 65

195383
AIR FLOW T-STAT
OPEN ON RISE

230110
1A, 250V SLO BLOW FUSE

420101
TRANSFORMER 24VCT, 25VA

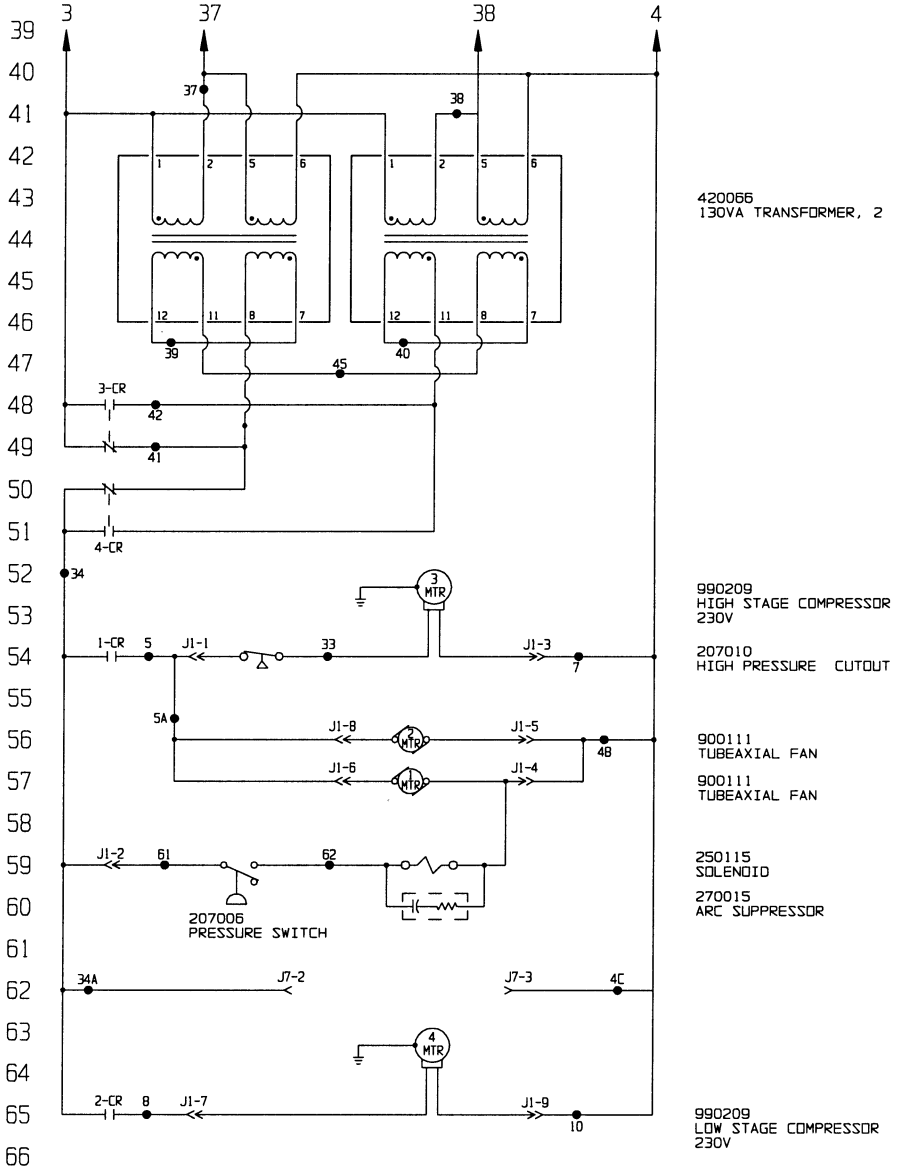
460024
RECORDER OUTLET

195382
VOLTAGE CORRECTION LED

300073
BOOST RELAY
50, 51

300073
BUCK RELAY
48, 49

Electrical Schematic
Forma Model:
771, 5477
6.7 cu. ft. ULT
Chest Freezer



Electrical Schematic
Forma Model:
771, 5477
6.7 cu. ft. ULT
Chest Freezer

WIRE REFERENCE CHART

WIRE #	GAUGE	COLOR
1	14	BRN
2	14	BLU
3	14	BRN
4	14	BLU
4A	18	BLU
4B	18	BLU
4C	18	BLU
5	14	BRN
5A	18	BRN
7	14	YEL
8	14	BLK
10	14	ORG
13	14	GRN/YEL
15	22	RED
16	22	YEL
17	22	ORG
18	22	BLK
19	22	WHT
20	22	RED
21	22	WHT
24	22	BLU
25	22	RED

WIRE REFERENCE CHART

WIRE #	GAUGE	COLOR
26	22	WHT
27	22	BLK
28	22	BLK
29	22	BLK
33	14	BRN
34	14	BRN
34A	18	BRN
35	18	ORG
36	18	YEL
37	18	BLK
38	18	BLK
39	14	ORG
40	14	ORG
41	14	RED
42	14	GRY
43	18	RED
44	18	BLU
45	14	YEL
53	22	RED
54	22	WHT
58	24	RED
59	24	BLK
60	24	WHT
61	18	BLK
62	18	BRN

REMOTE CONTACTS
PIN# 1 NORMALLY CLOSED
PIN# 2 COMMON
PIN# 3 NORMALLY OPEN

CONTACT RATING: 1A @ 30V

NOTES:

⊛	Denotes Terminal Strip Connection	Parts List Reference Number	
4-CR	Last Relay Number	○	Assembly
N/A	Last Terminal Number	⬠	Panel
62	Last Wire Number	⬡	Refrigeration
		□	Wiring

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

CUSTOMER APPROVAL/REFERENCE
APPROVED BY _____
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3	FR-1357	12-1-99	AT	AT	LDN	EMC UPDATES
2	FR-1296	04-26-99	CSA	KDG	LDN	CORRECT 203017 COMPRESSORS TO 990209
1	FR-1223	06-04-98	AT	KDG	LDN	CHG'D. TEMP. BOARD 190764 TO 190829
0	N/A	10-29-97	AT	AT	CBL	RELEASED FOR PRODUCTION

DATE 10-29-97	DWN AT		CAD AT	APPD CBL	SCALE NONE
CUSTOMER					
JOB TITLE 6.7 CUFT CHEST ULT FREEZERS (771, 5477)					
DWG TITLE ELECTRICAL SCHEMATIC					
LOCATION		JOB NUMBER		DRAWING NUMBER 771-70-0-D	

Electrical Schematic
Forma Model:
771, 5477
6.7 cu. ft. ULT
Chest Freezer

771-70-0-D REV. 4